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Abstract

"HERMES"

Fast superheater reactor

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(Sessions 1.1. to 1.4., Power reactors, type f)

The growing interest in the use of gases for fast reactor cooling is well known.

One of the most promising gases is unquestionably the water steam which allows to consider a direct cycle. The use of dry steam in a reactor avoids the difficulties encountered in superheater reactor design. As known, these difficulties are mostly related to the presence of wet steam. Furthermore the steam can be fed into the turbine at a temperature corresponding to the one generally used in modern plants.

The dry steam can be produced, either by a classical reactor with direct cycle or indirect cycle through a steam generator, either through a Loeffler's cycle utilizing accordingly one single reactor as the thermal source for the plant.

Since a few years already, some studies have been performed at BelgoNucléaire in designing a reactor suitable for superheating steam produced in reactors of a well tested type,

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These BelgoNucléaire studies are essentially based on a reactor of the "module" type. By "module", it is understood a pressure tube of relatively small diameter containing the fuel elements and used as a channel for the steam. These pressure tubes are juxtaposed. This pattern provides the necessary space between "modules" to install the detection and control devices for securing the plant operation.

The "modules" fit into a honeycomb structure in order to make their extraction easy for their possible replacement.

The reactor spectrum is essentially fast which allows use of appropriate structural materials, corrosion and radiation resistant at high temperature.

Since it is a fast reactor, a broad choice of cladding and dilution materials is also possible for the fuel elements. These fuel elements, depending on the design, could be clusters of elements made of uranium-plutonium mixed oxide, or spherical elements of the cermet type for instance.

The axial displacement of the fuel is possible. Partial loadings and unloadings are performed in order to optimize power distribution.

Among the advantages of the "module" pattern one can mention that the confinement of the fissile material is insured ipso facto in case of an accident and that the possible reactivity insertion during the partial or total water flooding of the core is easily controlled.

Beside the advantages related to the conception described, it is noteworthy to add those, well known, proper to the fast reactors and particularly their breeding ability.